DOCUMENT RESUME

ED 138 197 HE 008 862

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TITLE Behavior of Students with a Range of Preference for Structure in High Structure and Low Structure College Classrooms.
PUB DATE Apr 77
NOTE 37p.; Paper presented at the annual meeting of the American Educational Research Association (New York, April, 1977)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Academic Achievement; Analysis of Variance; Comparative Analysis; Correlation; *Course Organization; *Curriculum Design; Experiments; Statistical Analysis; *Student Attitudes; *Student Behavior; *Teaching Techniques
IDENTIFIERS Inventory of Beliefs

ABSTRACT

Four sections of introductory psychology were involved in a study of aptitude-treatment interactions. Two sections were taught with a high-structure curriculum, and two with a low-structure curriculum. Students' preference for structure was measured with the Inventory of Beliefs (IOB). During eight weeks of instruction, observers recorded students' verbal behavior in class, and selected students were questioned outside class about their thoughts in class, using the method of stimulated recall. Two achievement tests and one course satisfaction scale were administered during the experimental period. Correlations were tested by comparing regression slopes of dependent variables on IOB scores in the high- and low-structure sections. No correlations were found with achievement, satisfaction, verbal behavior, or thoughts in class. However, when the data were subjected to a two-factor analysis of variance (structure X IOB), a significant correlation did appear. This post-hoc analysis suggests that there may have been a significant relationship that was masked by imprecision in the regression analysis. (Author/MSE)

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ED138197

Behavior of Students with a Range of Preference for Structure in High Structure and Low Structure College Classrooms

A Paper Presented at the AERA Annual Meeting
New York, April, 1977

Session 27.06

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INTRODUCTION

The purpose of this study was to discover and describe some of the day-to-day behaviors which might account for an interaction between a student trait (preference for structure) and an instructional treatment (degree of structure). Most previous studies of aptitude-treatment interactions have involved only input variables (aptitude and treatment) and output variables (achievement and satisfaction). This study included intermediate variables (student behaviors and thoughts in class) as well.

Several previous studies have investigated the interaction between a student's preference for structure and the degree of class structure. Each study has defined structure in a different way; some did not even use the term "structure". However, in each of the studies to be cited here, there was one common element in the treatment variable: the degree to which a student could influence the class procedures. In each of these studies, the student had more control over the class procedures in the "low structure" treatment than in the "high structure" treatment. In the present study, structure was defined in terms of the degree to which a student can influence the class procedures.

REVIEW OF RELATED LITERATURE

Wispe (1951) studied the effects of directive and non-directive (permissive) teaching methods in an elementary social science course. He found that more students preferred the directive sections, and that the poorer students tended to do better in directive than non-directive classes.

Smith, et al. (1956) found that college students who were dependent on others for direction made optimum gains in reading achievement when exposed to a maximum of course structure and direction; minimum gains when exposed to a situation with little structure and direction. Students

with low dependent scores did equally well in both types of classes.

Amidon and Flanders (1961) studied the relationship between dependence proneness and teaching style in eighth grade. They found that dependent prone children learned more subject matter when their greater need for supervision and support was satisfied, while the learning of independent prone children was relatively unaffected by teaching style.

Domino (1971) selected college students with extreme scores on the Achievement-via-Conformance or the Achievement-via-Independence scales of the California Personality Inventory. He found that students who were taught introductory psychology in a manner consonant with their achievement orientation obtained significantly higher mean scores on course exams and gave higher ratings of teacher effectiveness than students taught in a dissonant manner.

Shaw (1975) studied achievement in three non-traditional college programs which used the same instructional materials (videotaped cassettes) but differed in other aspects of structure. He found that more dependent students did better than less dependent students in the highly structured program, worse in the loosely structured program, and about the same in the moderately structured program.

The present study was designed to have a close correspondence between the student characteristics defining preference for structure and the instructional characteristics of the classrooms in the study. This was achieved by first identifying, from a review of the previous studies, those student characteristics which define a preference for structure. Next, certain classroom characteristics were identified as being consonant or dissonant with each of these student characteristics. Those classroom

characteristics consonant with a preference for high structure defined a high structure classroom; those consonant with a preference for low structure defined a low structure classroom. Finally, to arrive at the hypotheses of the study, the expected reactions of students in a consonant or dissonant classroom situation were described.

DEFINITION OF STRUCTURE AND PREFERENCE FOR STRUCTURE

From a review of the preceding studies, the following characteristics were found to define a preference for high or low structure.

Preference for high structure	Preference for low structure
Dependent on the instructor for instructions	Decides on own procedures for study
Adheres to instructions	Ignores or resists instructions
Concerned with meeting instructor-set data	Concerned with meeting internal criteria
Desires to know instructor's criteria	Desires information to help set own criteria
Dependent on the instructor to define the significance of each topic	Prefers to decide for himself the significance of each topic
Dependent on the instructor to define the relationship of one topic to another.	Prefers to investigate the inter-relationships of topics for himself.

Next, from this list of characteristics, descriptions of classrooms which would be perceived as ideal by a student with a preference for high or low structure were developed. In this way, the definitions of high structure and low structure were related to student characteristics, rather than being arbitrarily defined.

HIGH STRUCTURE CLASS

Procedures:

a) A detailed syllabus is passed out
b) The syllabus is followed
c) Assignments are specific; the student does not have to choose among alternative assignments or develop his or her own assignment.

d) The student is given clear, detailed instructions on what to study for the exams
e) The instructor controls the classroom activities; deciding on the classroom format and the topic of discussion.

Criteria:

a) The instructor sets out detailed objectives for the class
b) The instructor sets out point requirements for each grade in advance
c) Standards for each assignment are made clear to the students; they know when the assignment is finished and can not be improved.
d) Frequent checks on the students' progress are made by the instructor
e) Exams are multiple choice, stressing facts

Content:

a) Content is presented in an organized, outline manner in class
b) The instructor provides a conceptual framework for the subject matter by providing a historical background for the material, stressing important points, showing the relationships of one topic to another, and leading students by providing facts, then showing how these are arranged into concepts.

LOW STRUCTURE CLASS

Procedures:

a) Open project assignments are given: the students can do a paper, survey, work project, or whatever, on any topic related to the course
b) Much class time is spent in open discussion which gives the student a chance to test his ideas
c) The instructor provides many resources which help students to explore the subject in several ways (eg: list of related books, names of resource people)
d) The format of the class sessions evolves according to the students' preferences.

Criteria:

a) Exams are essay or oral, in which the instructor tests the students' understanding of the subject
b) The student has opportunities to test his ideas against informational criteria: class discussions, presentation of case studies, etc.

Content:

a) The instructor presents the major topics of the subject matter, but allows students to select the specific areas they wish to pursue.
b) Assignments are of the type which require the student to relate various topics of the subject matter to each other.
c) The student is encouraged to develop a conceptual framework for the topics presented.

These class descriptions assume that the instructor provides a good deal of structure even in low structure classes. It was assumed that the student with a preference for low structure does not prefer to be completely independent of the instructor, or else he or she would not be in the class at all. Rather, in the low structure class, the instructor is seen as a resource person, who presents information and helps students evaluate their ideas.

The hypothesis will be presented after a description of the research methodology.

METHOD

Sample

Participants were students enrolled in Introductory Psychology at a midwestern urban university. Students enrolled for either a 9:00 or a 10:00 class period, and were randomly assigned to either a high structure or a low structure class in that time period. The random assignment was stratified by race and sex. A total of 156 students enrolled in the four sections. Of these, 94 remained in the usable sample at the end of the experimental period. Of the others, 20 dropped the course, one was eliminated because he spoke little English, four were eliminated for severe absenteeism, and 37 were unable to participate in the stimulated recall session, which required that they be present two specific days. The students were primarily freshmen or transfer students. Fifty-one percent were female; seventy-five percent were black. The average ACT Composite score was 14.6, compared to the national mean of 18.9.

The students were informed that their sections of Introductory Psychology were involved in a study of teaching styles, but were not told any further details of the study. Students were given the option of continuing in the class without participating in the study, but all 156

students who enrolled in the class signed consent forms for participation in the study and access to their records. At the conclusion of the experimental period, the study was discussed in class, as an example of a psychological experiment.

Treatment

Each of the two instructors taught one class section in a high structure manner and one in a low structure manner, following the characteristics of high and low structure classes described previously. All other characteristics of the four classes, including amount of student participation, access to the instructors outside class, and personal support by the instructors, were kept the same in all four classes. Mr. Shaw taught a high structure class at 9:00 (H1) and a low structure class at 10:00 (L2). Mrs. Bunt taught a low structure class at 9:00 (L1) and a high structure class at 10:00 (H2). To maintain consistency in the teaching styles across instructors, the two instructors met before and after class each day to plan the upcoming classes, and listened to tape recordings of each others' classes.

There were three checks on the actual degree of structure in each section. First, two observers rated the degree of structure of each section, using a checklist based on the high structure and low structure characteristics described. Each section was rated twice weekly. Second, each instructor rated the classes he or she taught each day, using the same checklist. Third, at the end of the experimental period, students were asked to complete a student perception questionnaire dealing with certain course characteristics. The results of these three procedures appear in Tables 1 and 2. These tables show that the two high structure classes were indeed higher in structure than the two low structure classes, as

measured by the three procedures.

-- TABLES 1 and 2 here --

The experimental period consisted of the first eight weeks of the course. Classes met three times a week, for a total of 24 class sessions in the experimental period. During the first two weeks of the course, one content unit was covered: an overview of the topics and methods of psychology. Achievement data were not collected during the first two weeks for three reasons:

1. We wished to give students time to get used to the degree of structure in their section.
2. A number of students drop or add courses during the first two weeks.
3. Approximately two and a half of the first six class periods were taken up with the administration of instruments used in the study.

During the third to eighth weeks of the study, two units of material were covered: physiological psychology and perception. These two units were chosen because most students have had little previous experience with these topics. Achievement data were based only on material covered in these two units. Data on student thoughts and verbal behavior were collected during the entire eight weeks.

DATA INSTRUMENTS

A. MEASURE OF STUDENT PREFERENCE FOR STRUCTURE

1. Inventory of Beliefs (IOB): This is a measure of a student's preference for structure, developed by Stern, et al. (1956), and shortened to seventeen items by Ginther (1974). It is based on the work of Adorno, et al. (1950). This instrument has been found to validly classify people on the basis of preference for structure in studies by Stern, et al. (1956) (college students); Berlin (1965) (high school students); Ginther (1974) (adult patients in a nutrition clinic); and Shaw (1975)

(adult education students). The Kuder-Richardson Formula 20 reliability estimate for the short form was .70 in the present study. A high score on the IOB indicates a high preference for high structure.

B. COVARIATES

2. ACT score: The Composite ACT score was used as a covariate in the analysis of achievement data. All students in the course gave permission for the use of their ACT scores. Of the 131 students who completed the course, 112 had taken the ACT. Of the 94 students in the final sample, 79 had taken the ACT.

3. Demographic Questionnaire: This was completed by students on the first day of class. In addition to standard information (age, sex, year in school, marital status, etc.), the questionnaire requested information on previous experience with psychology and related subjects.

C. DEPENDENT VARIABLES

4. Achievement tests: Two achievement tests were given during the experimental period, the first on physiological psychology; the second on perception. Each consisted of 35 multiple-choice questions and one essay question worth 10 points. Both tests were prepared by the two course instructors, using standard content validity procedures, and included items dealing with the first three levels of cognitive process described in Bloom's Taxonomy of Educational Objectives, Cognitive Domain. The same tests were used in all four sections. The combined reliability (KR20) of the multiple choice parts of the two tests was .87. The essay question on each test was graded by both instructors, using an answer shell constructed before the exam was given. When the grades assigned by the two instructors differed, they arrived at a common grade by consensus. In no

case did the grades assigned by the two instructors differ by more than three points.

5. Satisfaction Scale: This scale, developed by the authors, was given at the end of the experimental period (ninth week of the course). The first item asked the student to rate his or her satisfaction with the class in general on a scale of zero to nine. In addition, nine Likert-type items measured the student's satisfaction with specific features of the class -- those features which made the class high or low in structure. These ten items were combined to form one scale. The reliability of the scale, estimated by Cronbach's alpha, was .69.

6. Student's verbal behavior in class was recorded by observers who were present in the classroom two days each week. The observers made a written record of all student comments and questions, sorted into the seven categories shown in Figure A. The categories are exhaustive and mutually exclusive.

-- FIGURE A here --

Each section of the class was observed for fifteen of the 24 class sessions. For the data analysis, the raw numbers in each category for each student were converted to proportions by dividing the number in each category by the total number of verbal units made by that student. This was done so that active talkers would not have a disproportionate influence in the analysis.

Inter-observer reliability for coding the verbal behavior was quite high. The observers overlapped on six class sessions. For these six sessions, there was a correlation of .95 between the total number of verbal units coded by each observer. Agreement in coding into categories was also high. Out of a total of 261 verbal units observed during the six sessions,

the two observers disagreed on the coding into categories of only ten units (5.8 per cent).

The verbal behavior data were also analyzed to determine intra-person reliability, that is, the consistency with which a student says things in one category rather than another. This reliability was estimated by randomly splitting the class sessions into two time samples. The proportions of verbal behavior in each category for each student were computed for time sample one and time sample two, and these figures were correlated. These correlations are shown in Table 3. The correlations ranged from .36 to .03. Only three of seven were significant at the .05 level or better. Apparently the types of things a student says vary greatly, depending on the situation. The total volume of verbal behavior was much more reliable. The correlation between total number of verbal units in time sample one and time sample two was .79 ($p < .001$).

-- TABLE 3 here --

7. Stimulated Recall: Six to ten students from each section participated in three stimulated recall sessions during the experimental period. The sessions were conducted after class by someone unaware of the hypotheses of the study. In addition, all students who were not absent participated in a fourth stimulated recall session conducted during class. In the stimulated recall sessions, segments of a tape recording made in a previous class meeting were played for the students. The segments were recordings of incidents which were particularly high or low in structure (depending on the section). Each segment was from one to one and one-half minutes long. After the segment had been played, students were asked to write down what they had been thinking and/or feeling at that point in class. Five or six segments were played in each session.

This method was developed by Bloom (1953, 1954), and has been used by Gaier (1951), Schulz (1951), Berlin (1965), Anderson (1973), and Özçelik (1974). That the method is valid is indicated by the fact that students can accurately recall overt events when a recording is played back (Bloom, 1953), and by students' expressions of surprise at remembering what they were thinking the day before (Berlin, 1965).

The written responses of the students were rated along three dimensions: degree of educational involvement with the class content, degree of educational involvement with the class process, and degree of positive affect. The categories which make up each dimension are shown in Figure B.

-- FIGURE B here --

The phrase "educational involvement" was used in describing the first two dimensions to restrict the types of involvement which would be included in the dimensions. It was expected that a student in a class consonant with his or her preference for structure would become involved with the class in such a way that the student's achievement would be increased. It was also expected that a student in a class dissonant with his or her preference for structure would be aware of the class content and process, even to the extent of trying to change the content or process of the class, but would not be involved in the class in such a way that his or her achievement would be improved. Therefore, the dimensions described in Figure B are intended to represent differences in type of involvement, as well as degree of involvement.

Within each dimension, each category was assigned a numerical value indicating its position along the continuum defined by the dimension. These values were assigned by a panel of teachers. A student's responses to the

stimulated recall segments were given a score for each of the three dimensions. These scores were computed by multiplying the weight of each category by the proportion of the student's responses which fell into that category. These products were then summed to arrive at the dimension score. For example, the score for the first dimension (degree of educational involvement with the class content) was computed by the formula:

$$D1 = (4.38)(A) + (6.16)(B) + (7.38)(C) + (1.0)(D),$$

where A,B,C, and D represent the categories in dimension one, and the coefficients are the values assigned to the categories by the panel of teachers.

Stimulated recall data were analyzed to determine the intra-person reliability of the student's thoughts in class -- that is, the consistency of their degree of educational involvement and affect from incident to incident in the class. To determine this reliability, the stimulated recall segments were randomly split into two samples. The students' ratings along the three dimensions were obtained for each of the two samples in the manner just described. Each student's rating on each dimension in sample one was correlated with the same student's rating on the same dimension in sample two. These correlations are shown in Table 4. All three correlations are high, indicating a good deal of consistency in the nature of the student's thoughts in class from incident to incident.

-- TABLE 4 here --

HYPOTHESES

The hypotheses for the study are phrased in terms of differences in regression slopes in high structure classes versus low structure classes. As Cronbach and Snow (in press) have pointed out, phrasing ATI hypotheses in terms of regression slopes rather than ANOVA interaction terms allows a more powerful test of the hypotheses. The study had five major hypotheses. The hypotheses were based upon previous research findings and upon deductions about how a student was likely to behave in a class consonant or dissonant with his or her preference for structure.

VERBAL BEHAVIOR

In general it was expected that a student's verbal behavior would tend to move the class towards the degree of structure preferred by that student. It was also expected that a mis-matched student would be more active in his attempts to change the structure of the class than a matched student. These expectations are represented by the first two hypotheses.

H1: For those verbal behaviors which reflect student attempts to increase the structure of the class (categories 2-4), the regression of student behavior on IOB scores will have a greater positive slope in low structure than high structure classes.

H2: For those verbal behaviors which reflect student attempts to gain more freedom from class structure (categories 5-7), the regression of student behavior on IOB score will have a greater negative slope in high structure classes than low structure classes.

THOUGHTS IN CLASS

It was expected that the thoughts of matched students would indicate a greater degree of educational involvement, and more positive affect, than the thoughts of mis-matched students. This expectation is represented by the third hypothesis.

H3: The regression of degree of involvement on IOB score will have a greater positive slope in high structure classes than low structure classes.

SATISFACTION

It was expected that matched students would be more satisfied with the course than mis-matched students. This is consistent with Domino's (1971) finding that matched students gave more positive course evaluations than mis-matched.

H4: The regression of satisfaction score on IOB score will have a greater positive slope in high structure classes than low structure classes.

ACHIEVEMENT

It was expected that matched students would have higher achievement scores than mis-matched students. This is consistent with the findings of Smith, et al., (1956), Amidon and Flanders (1961), Domino (1971), and Shaw (1975).

H5: The regression of achievement score on IOB score will have a greater positive slope in high structure classes than low structure classes.

RESULTS

DESCRIPTION OF THE DATA

Means and standard deviations for all variables, by section, are presented in Table 5. There were few differences among the sections on any of the variables. Differences among section means were tested for significance with Analysis of Variance, followed by Scheffe's test of significance between means. For convenience, the significant contrasts are listed in Table 6.

-- TABLE 5 here --

-- TABLE 6 here --

Apparently, randomization failed to equalize the high and low structure sections with respect to one input variable: Inventory of Belief scores. The mean IOB for high structure sections was 6.23;

the mean for low structure sections was 7.91 ($p < .05$). When individual section means were tested, it was found that the mean IOB score was significantly higher for section H1 than the mean for section H2 ($p < .05$), but no other contrasts were significant. Because the hypotheses of the study do not involve comparisons among section means, this significant difference in the student trait scores does not invalidate the study. These differences in IOB scores only tend to increase the degree of "mis-match" between the degree of class structure and the students' preference for structure. Since the hypotheses are primarily concerned with the reactions of "mis-matched" students, the section differences in IOB merely make the test of the hypotheses all the more powerful.

There was only one significant difference between the high and the low structure sections on the means of the dependent variables. Students in the high structure sections had a higher proportion of verbal units in the "answering questions" category than students in the low structure sections (78.5% vs. 44.0%; $p < .001$). This was because the instructors posed more direct questions to the students in the high structure sections. Students in the low structure sections had less opportunity to answer questions.

At any rate, differences in means between the high structure and low structure sections were not expected, and do not bear directly on the hypotheses of the study. The hypotheses are concerned with the relationship between student behaviors and IOB scores in the various sections. The hypotheses will be discussed now.

TESTS OF THE HYPOTHESES

The general hypothesis of the study was that the relationship between a student's preference for structure (measured by the IOB) and the student's

behavior (achievement, satisfaction, verbal behavior, and thoughts) would depend on the degree of structure in the student's class. A hypothesis of this nature can be tested by comparing the regression of each type of student behavior on preference for structure in both high structure and low structure classes. If the slope of regression in the high structure classes differs significantly from the slope of regression in the low structure classes, the hypothesis is supported. The test of parallelism of regression slopes was carried out as described by Finn (1974, pp. 379-398) and Bock (1975, p. 385). In this method, the multivariate regression of dependent on independent variables is first computed for the total sample, ignoring group divisions. The regressions for each group (high structure and low structure) are then computed. These latter results are pooled and compared with the regression for the total sample. If the separate group regressions account for significantly more of the variance in the dependent variables than the single common regression, the group regression lines are shown to be non-parallel. The Multivariance program (Finn, 1972) was used to compute the regression parallelism test. A multivariate analysis of the data was conducted because the various dependent variables were correlated with each other.

Before the MANOVA was conducted, two students were eliminated from the sample because of extreme values in two verbal categories. Each had made only one statement in the entire experimental period, which converted to a percentage score of 100% in categories four and seven, respectively. The mean score in these two categories was less than 3%. The two students were eliminated as outlyers, leaving a sample of 92 students.

The test of all hypotheses was conducted in one analysis, contrasting the slopes of student behaviors on IOB scores in high structure sections

(H1+H2) with the slopes in low structure sections (L1+L2). Table 7 is an abbreviated multivariate analysis of variance (MANOVA) table for this analysis.

-- TABLE 7 here --

As Table 7 shows, none of the differences in slopes was significant. The multivariate F-ratio is 1.11 (n.s.), and only one of the univariate F-ratios even approaches significance ("Asking questions which tend to clarify objectives, etc."; $F=3.70$; $p< .06$). When the analysis was repeated using ACT Scores as a covariate, the results were the same: no significant differences in slope were found.

Following the tests of hypotheses, a two-factor analysis of variance was carried out, with achievement and satisfaction as dependent variables. The two factors were class structure (high and low) and Inventory of Beliefs scores (dichotomized at the median). ACT scores were used as a covariate. The analysis was conducted on the total sample of 112 students for whom ACT scores were available, to maximize the power of the test. The MANOVA table for this analysis is presented in Table 8.

-- TABLE 8 here --

There was a significant interaction between structure and dichotomized IOB scores with respect to achievement, but not satisfaction. The cell means for achievement (observed and adjusted for ACT scores) are shown in Table 9. One cell (high IOB students in low structure classes) is significantly lower than each of the other cells. This is consistent with the studies of Smith, et al. (1956) and Amidon and [illegible] 1961), who found that degree of structure had more effect on students who prefer high structure than students who prefer low structure.

-- TABLE 9 here --

Cronbach and Snow (in press) recommend testing ATI's with a regression analysis in which main effects are entered before ATI effects (represented by multiplying a dummy variable times the aptitude measure). For purposes of comparing methods of analysis, such an analysis was computed for the sample of 112 students. The results are presented in Table 10. The ATI effect was not significant.

-- TABLE 10 here --

MAIN EFFECTS

Only two "input" variables showed significant relationships with dependent variables. IOB scores and ACT scores were significantly related to achievement. These relationships are shown in Table 11.

-- TABLE 11 here --

DISCUSSION

None of the hypotheses, phrased in terms of regression slopes, was supported. However, an analysis of variance did show a significant interaction involving achievement. The interaction was in the expected direction. The failure of regression analysis to detect the interaction is worth noting. The discrepancy between the regression analyses and the ANOVA may be due to imprecision in IOB scores or achievement scores. Both measures had reasonably high internal consistency estimates (KR20) of .70 and .87, respectively. However, no test-retest reliability estimates were available to the authors. "Chunking" subjects into groups may allow an ANOVA to detect differences between cells which would be masked by imprecision in a regression analysis. Because educational research often uses measures of less than perfect reliability, regression analysis may not always be the method of choice in ATI studies.

At any rate, since the analysis of variance was post-hoc, this study gave only limited support to the existence of aptitude-treatment interactions involving achievement. There was no evidence whatsoever that the verbal behaviors observed in the study mediate an ATI involving achievement. Because the verbal behavior fluctuated so greatly over time, it seems extremely unlikely that the verbal behaviors observed in this study contribute to any interaction between personality and instructional treatment. There was also no evidence that the dimensions of student thoughts observed in this study mediate interactions involving achievement. Finally, there was no evidence of an interaction involving satisfaction with the course.

There is little question that the experimental treatments were carried out as planned. The lack of evidence of interactions cannot be attributed to a lack of difference between the two types of classes. Note, however, that the classes differed only in degree of structure. Other factors which have been varied along with structure in previous studies, such as amount of participation and degree of personal support from the instructor, were kept the same in all four sections in this study. s possible that these factors work in unison to produce differential ts in students.

Finally, it should be pointed out that there were no significant main effects of degree of classroom structure on any of the dependent variables (except number of answers to questions; a function of the number of questions in each style of teaching). There was a significant main effect of IOB scores on achievement. Student aptitude was a more powerful predictor of achievement than instructional method or any ATI.

FUTURE RESEARCH

Clearly, the aptitude-treatment interactions which have been demonstrated in previous studies must result from some differences in behavior, either overt or covert, in different treatments. The current study demonstrated a methodology for studying these differences.

Most previous studies have covered a relatively short period of time. Perhaps ATI effects are stronger in a short time period than a long period (or vice-versa). An analysis will be made of the achievement data from the current study, comparing students' scores on the first achievement test with their scores on the second. Future studies should cover relatively long time periods, and collect dependent measurements at regular intervals to look for trends throughout a course of instruction.

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TABLE 1

MEAN STRUCTURE CHECKLIST SCORES

FOR EACH SECTION, BY RATER

(Standard Deviations in Parentheses)

	SECTION			
RATER	L1	L2	H1	H2
Shaw	—	16.6 (1.0)	27.1 (1.2)	—
Bunt	18.8 (3.4)	—	—	28.3 (2.5)
Observer A	23.6 (5.0)	15.1 (3.1)	27.1 (4.3)	27.9 (2.0)
Observer B	22.7 (3.8)	19.0 (3.7)	26.6 (5.0)	28.0 (1.7)
Combined	20.9 (3.2)	17.0 (1.9)	27.0 (2.0)	28.1 (1.7)

Analysis of Variance Table

Source	df	MS	F	p<
Among	3	49.50	9.60	.001
Within	170	5.16		

The means for each rater were obtained by finding the mean of all the scores given to a particular section by that rater, one score for each day the rater observed a particular section. The Combined means were obtained by finding the mean of all scores given to a particular section by all three raters -- the instructor and the two observers. The instructors rated only their own sections, since they were never present during the other instructor's classes. Each section was rated at least 42 times. Scheffe's test of contrasts shows that sections L1 and L2 are each significantly lower in checklist score than sections H1 and H2.

TABLE 2

MEAN CLASSROOM PERCEPTION SCORES OF STUDENTS
BY SECTION

(Standard Deviations in Parentheses)

SECTION:	L1	L2	BOTH	H1	H2	BOTH	TOTAL
	76.34	73.57	75.12	81.09	82.10	81.57	78.22
	(7.90)	(7.91)	8.05	(6.11)	(8.65)	7.13	(8.32)

ANOVA TABLE FOR CLASSROOM PERCEPTION SCORES

source	df	MS	F	p<
among	3	502.14	8.25	.001
within	127	60.83		

Scheffe's test of contrasts shows that sections L1 and L2 are each significantly lower in mean perception score than the two high structure sections, H1 and H2. No other contrasts are significant.

FIGURE A

VERBAL BEHAVIOR CATEGORIES

Neutral verbal behaviors:

1. Answering questions

Verbal behaviors which tend to increase class structure:

2. Asking questions to clarify objectives, procedures, and criteria of the course

3. Asking questions to clarify the conceptual framework for material presented in the course

4. Supporting others in (2) or (3)

Verbal behaviors which tend to decrease class structure:

5. Asking questions or making comments about topics not directly relevant to the present discussion

6. Suggesting an alternate conceptual framework for concepts presented in the course

7. Supporting others in (5) or (6)

TABLE 3

INTRA-PERSON RELIABILITY ESTIMATES FOR VERBAL CATEGORY PROPORTIONS

VERBAL CATEGORY	CORRELATION OF TIME SAMPLE ONE WITH TIME SAMPLE TWO
answering questions	.36***
clarifying objectives	.09
clarifying concepts	.10
support others	-.04
off topic	.19*
suggest concept	.29**
support others	.03
total verbal units (raw, not proportion)	.79***

*p<.05

**p<.01

***p<.001

FIGURE B

STIMULATED RECALL CATEGORIES

VALUE		
	I.	DEGREE OF EDUCATIONAL INVOLVEMENT WITH CLASS CONTENT (ABBREVIATION: Content)
4.38	A.	Describing topic (paying attention)
6.16	B.	Personal association to the topic
7.38	C.	Elaboration of the topic
1.00	D.	Out of field (Irrelevant)
0.0	E.	Can't remember
	II.	DEGREE OF EDUCATIONAL INVOLVEMENT WITH CLASS PROCESS (ABBREVIATION: PROCESS)
3.21	A.	Passive participation in class process
4.16	B.	Active participation in class process
6.66	C.	Planning, anticipating, imagining a learning activity
8.23	D.	Desire to participate/study/do assignments
1.00	E.	Out of field (Irrelevant)
0.0	F.	Can't remember
	III.	DEGREE OF POSITIVE AFFECT (ABBREVIATION: Positive)
0.0	A.	Expresses strong negative feelings about the activity on the tape.
0.73	B.	Expresses tacit disapproval of the activity on the tape (expressions of unwillingness to participate, dislike of the topic, etc.)
3.53	C.	Neutral (includes "out of field" and "can't remember")
6.50	D.	Expresses tacit approval of the activity on the tape (expressions of interest, willingness to participate, etc.)
7.93	E.	Expresses strong positive feelings about the activity on the tape.

TABLE 4

INTRA-PERSON RELIABILITY ESTIMATES FOR
STIMULATED RECALL DIMENSIONS

DIMENSION	CORRELATION OF SAMPLE ONE WITH SAMPLE TWO
Degree of educational involvement with the class content	.54*
Degree of educational involvement with the class process	.52*
Degree of positive affect	.43*

*p<.001

TABLE 5

MEANS AND STANDARD DEVIATIONS OF ALL VARIABLES

variable	low structure sections L1	L2	both	high structure sections H1	H2	both	TOTAL
IOB	8.92 (3.88)	6.60 (3.30)	7.91 (3.91)	7.12 (3.31)	5.33 (2.91)	6.23 (3.16)	7.05 (3.56)
*ACT Composite	12.90 (3.70)	15.69 (3.84)	14.11 (3.96)	14.71 (5.25)	16.59 (5.46)	15.67 (5.86)	14.95 (5.10)
Perceived Structure	75.27 (7.86)	72.20 (8.14)	73.93 (8.05)	80.58 (6.48)	82.08 (8.95)	81.33 (7.77)	77.71 (8.69)
Achievement	55.15 (9.21)	66.50 (10.89)	60.09 (11.09)	61.50 (10.55)	64.04 (15.01)	62.77 (12.90)	61.46 (12.19)
Satisfaction	35.77 (5.04)	38.00 (3.57)	36.74 (4.55)	38.00 (3.76)	36.83 (4.75)	37.42 (4.28)	38.08 (4.41)
Verbal Behavior:							
Answering Questions	37.75 (41.30)	50.92 (32.40)	44.04 (37.79)	76.30 (26.40)	80.69 (18.48)	78.49 (22.65)	61.63 (35.35)
Structuring Verbal Behav.	7.90 (13.98)	29.48 (28.53)	17.28 (23.86)	18.93 (24.31)	13.43 (14.06)	16.18 (19.84)	16.72 (21.79)
Clarify Objectives	3.44 (10.22)	6.34 (8.10)	4.70 (9.37)	3.99 (7.44)	1.86 (4.73)	2.92 (6.26)	3.79 (7.94)
Clarify Concepts	4.01 (9.18)	16.14 (22.50)	9.29 (17.25)	13.73 (22.50)	10.36 (10.84)	12.04 (17.55)	10.70 (17.37)
Support Others	.47 (1.71)	6.85 (22.03)	.32 (14.72)	1.14 (2.70)	1.14 (3.30)	1.14 (2.98)	2.17 (10.51)
De-structuring Verbal Behav.	3.30 (10.04)	13.12 (13.93)	7.57 (12.73)	4.50 (8.14)	5.63 (6.77)	5.07 (7.43)	6.29 (10.39)
Off Topic	.70 (2.[illegible])	8.11 (11.28)	3.93 (8.49)	2.78 (5.58)	1.56 (2.90)	2.17 (4.44)	3.03 (6.76)
Support Concept	.[illegible] (3.[illegible])	4.66 (5.98)	2.41 (4.69)	1.47 (4.36)	3.62 (4.96)	2.54 (4.75)	2.48 (4.65)
Support Others	1.91 (9.77)	1.34 (2.26)	1.65 (7.43)	.21 (.76)	.40 (1.11)	.30 (.95)	.97 (5.26)
Total Verbal Units	10.29 (17.62)	22.63 (37.01)	15.74 (28.33)	12.76 (14.09)	17.77 (14.68)	15.14 (14.48)	15.45 (22.16)
Stimulated Recall:							
Content	3.85 (1.28)	4.13 (1.07)	3.98 (1.13)	4.38 (1.27)	3.36 (1.73)	3.87 (1.58)	3.92 (1.39)
Process	2.98 (1.21)	3.39 (1.05)	3.39 (1.12)	3.23 (1.17)	2.73 (1.32)	3.00 (1.25)	3.18 (1.24)
Positive Affect	.04 (.13)	.36 (.20)	.19 (.20)	.09 (.14)	.05 (.14)	.07 (.14)	.13 (.20)

TABLE 6

SIGNIFICANT DIFFERENCES BETWEEN
HIGH STRUCTURE AND LOW STRUCTURE SECTIONS

variable	low structure mean	high structure mean	F	p<
IOR	7.91	6.23	5.51	.05
Classroom Perception	73.93	81.33	20.57	.001
Answering Questions	44.04%	78.49%	29.02	.001

TABLE 7

MULTIVARIANCE ANALYSIS OF VARIANCE TABLE FOR REGRESSION PARALLELISM TEST TESTING EQUALITY OF SLOPES IN HIGH STRUCTURE VS. LOW STRUCTURE SECTIONS

Dependent variable	univariate F	p<
Achievement	0.2619	0.6101
Satisfaction	0.7432	0.3910
Clarifying objectives	3.7015	0.0576
Clarifying concepts	0.4273	0.5151
Supporting others in structuring	1.4642	0.2294
Off topic questions	1.4010	0.2397
Suggest concept	1.9643	0.1645
Support others in de-structuring	1.5657	0.2141
Stimulated recall content	1.2477	0.2670
Stimulated recall process	0.8413	0.3615
Stimulated recall positive	1.4244	0.2358

d.f. for hypothesis:	1
d.f. for error:	90
Multivariate F=	1.1070
p less than:	0.3665

TABLE 8

TWO-WAY MULTIVARIATE ANALYSIS OF VARIANCE TABLE,
CLASS STRUCTURE BY IOB SCORE,
ACT SCORE USED AS A COVARIATE

SOURCE	MS	DF	F	p<
STRUCTURE		2	0.71	.50
Achievement	47.39	1	0.54	.46
Satisfaction	14.36	1	0.78	.38
IOB		2	3.09	.05
Achievement	437.45	1	5.03	.03
Satisfaction	15.87	1	0.86	.36
INTERACTION		2	4.46	.02
Achievement	674.21	1	7.75	.007
Satisfaction	32.98	1	1.78	.19
ERROR		106		
Achievement	86.98	107		
Satisfaction	18.52	107		

TABLE 9

MEAN ACHIEVEMENT SCORES ADJUSTED FOR ACT SCORES, BY TWO-FACTOR ANOVA CELLS
(Unadjusted Means in Parentheses)

		IOB SCORE	
		LOW (0-6)	HIGH (7-17)
CLASS STRUCTURE	LOW	65.64 (65.75)	56.23 (53.58)
	HIGH	63.00 (66.73)	61.93 (60.73)

Scheffe's test of contrasts shows that cell II (low class structure/high IOB score) is significantly lower than each of the other cells.

TABLE 10

STEP-WISE REGRESSION WITH ACHIEVEMENT
AS THE DEPENDENT VARIABLE

independent variable	b	SE_b	beta	R^2	F	p
ACT Composite	1.14	.22	.48	.32078	27.92	.001
IOB	-0.69	.32	-.19	.36073	4.48	.01
Structure	-2.19	4.58	-.19	.36087	0.23	ns
Structure x ACT	.06	.21	.08	.36379	0.08	ns
Structure x IOB	.22	.32	.14	.36366	0.46	ns
(constant)	50.17					

TABLE 11

REGRESSION SLOPES OF ACHIEVEMENT
ON IOB AND ACT SCORES

independent variable	dependent variable	slope	standardized slope	F	p<
IOB	Achievement	-1.36	-0.40	17.27	.001
ACT Composite	Achievement	1.47	0.61	45.91	.001